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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებში.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи.** Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html. В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე, დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემავსებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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PREVENTION OF LOCAL POSTOPERATIVE COMPLICATIONS IN THE SURGICAL TREATMENT OF CHRONIC VENOUS INSUFFICIENCY OF THE LOWER EXTREMITIES (CEAP C3–C5)

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Abstract.

Introduction: Chronic venous insufficiency of the lower extremities remains one of the most significant problems of modern vascular surgery and angiology because of its high prevalence, progressive course, and association with edema, trophic skin changes, and impaired quality of life. In patients with CEAP C3–C5 disease, the outcome of surgical treatment depends not only on elimination of pathological venous reflux, but also on the degree of surgical trauma and the risk of local postoperative complications.

Aim: To evaluate the effect of a modified dissection technique for incompetent perforating veins with preservation of the accompanying artery on the incidence of local postoperative complications in patients with CEAP C3–C5 chronic venous insufficiency of the lower extremities.

Materials and methods: A single-center prospective non-randomized comparative clinical study was conducted at the Department of Cardiovascular Surgery of the Medical Hospital of Semey State Medical University in 2018–2021. The study included 62 patients aged 22 to 48 years with clinically significant chronic venous insufficiency of the lower extremities CEAP C3–C5 who required surgical treatment. The main group consisted of 32 patients who underwent modified dissection of incompetent perforating veins with preservation of the accompanying artery, whereas the comparison group included 30 patients operated on using the conventional technique. Preoperative assessment included clinical examination, duplex ultrasound scanning, CEAP classification, and VCSS scoring. The primary endpoint was the overall incidence of local postoperative complications; the secondary endpoint was the change in VCSS over follow-up. Statistical analysis was performed using Fisher's exact test and the Mann–Whitney U test; $p < 0.05$ was considered statistically significant.

Results: The groups were comparable at baseline in age, CEAP clinical class distribution, and initial VCSS values. In the comparison group, local postoperative complications occurred substantially more often than in the main group. Subcutaneous hematomas were observed in 26.7% versus 6.3% of patients ($p = 0.040$), postoperative limb edema in 40.0% versus 3.1% ($p < 0.001$), ecchymosis in 10.0% versus 0, and skin necrosis

in 6.7% versus 0, respectively. The overall incidence of at least one local postoperative complication was 53.3% in the conventional surgery group and 9.4% in the modified surgery group ($p = 0.00024$). Absolute risk reduction was 43.9%, relative risk was 0.18, relative risk reduction was 82.4%, and the number needed to treat was 2.3. VCSS dynamics also favored the modified technique: at 6 months the score was 5 [4;6] versus 6 [5;8] ($p = 0.028$), and at 12 months it was 4 [3;5] versus 6 [5;7] ($p = 0.011$) in the main and comparison groups, respectively.

Conclusions: The modified dissection of incompetent perforating veins with preservation of the accompanying artery was associated with a significant reduction in the incidence of local postoperative complications in patients with chronic venous insufficiency of the lower extremities CEAP C3–C5 compared with the conventional technique. The method is associated with a more favorable early postoperative course and better subsequent clinical improvement according to VCSS, which supports its use as a tissue-sparing and pathogenetically justified surgical approach.

Key words. Chronic venous insufficiency, CEAP, perforating veins, postoperative complications, venous surgery, VCSS, lower extremities.

Introduction.

Chronic venous diseases of the lower extremities remain one of the most common causes of reduced quality of life among patients of working age and a significant clinical challenge in modern angiology and vascular surgery. The high prevalence of venous pathology, its long-term progressive course, the tendency for symptoms to become chronic, and the development of trophic disorders determine its substantial medical and social significance [1–3]. In clinical practice, the greatest significance lies not only in the presence of varicose veins but also in the degree of venous outflow decompensation, reflected in the severity of edema, skin changes, and impaired tissue repair. According to the modern CEAP classification, it is precisely classes C3–C6 that characterize clinically significant forms of chronic venous insufficiency, in which the disease goes beyond a primarily cosmetic problem and is accompanied by persistent functional and trophic disorders [2,4].

Patients with CEAP clinical classes C3–C5 are of particular interest. At this stage of the disease, chronic venous hypertension is already accompanied by interstitial edema, hyperpigmentation, induration of the skin and subcutaneous tissue, lipodermatosclerosis, and, in some patients, healed venous ulcers. These changes reflect not only the severity of local venous damage but also the presence of microcirculatory disorders, impaired tissue perfusion, and inflammatory remodeling in the area of chronic venous insufficiency [5,6]. Therefore, in this patient population, the outcome of surgical treatment is determined not only by the complete elimination of pathological venous reflux but also by how carefully the procedure is performed and to what extent local postoperative complications can be prevented.

Despite the widespread adoption of endovenous techniques, surgical treatment remains an important component of the management of patients with chronic venous insufficiency, particularly in cases of combined involvement of superficial and perforating veins, severe clinical manifestations of the disease, and the presence of trophic changes [2,3]. Current clinical guidelines emphasize the importance of duplex ultrasound scanning in verifying pathological reflux, determining the anatomical pattern of the lesion, and selecting a treatment strategy [2]. However, even with proper preoperative planning, the immediate outcomes of the procedure depend not only on the elimination of hemodynamically significant venous shunting but also on the degree of surgical trauma, the extent of tissue dissection, and the preservation of local microcirculation in the surgical site [2,7,8].

Local postoperative complications following surgical treatment of chronic venous insufficiency retain independent clinical significance, as they largely determine the course of the early postoperative period, the need for additional dressings, the timeline for local recovery, and the patient's subjective assessment of the treatment outcome. The most common local complications include subcutaneous hematomas, ecchymoses, postoperative edema, inflammatory changes in the wound area, impaired healing, and necrotic skin changes [7,8]. Their development is particularly undesirable in patients with CEAP clinical classes C4–C5, in whom the tissues are initially subjected to chronic venous hypertension, edema, inflammatory remodeling, and trophic changes [5,6,9].

The insufficiency of perforating veins plays a significant role in the pathogenesis of chronic venous insufficiency and the progression of local disorders. Horizontal pathological reflux maintains the redistribution of venous pressure between the deep and superficial systems, contributes to the persistence of venous hypertension in the distal segments of the limb, and exacerbates trophic disorders [2,9]. At the same time, the question of the appropriate site for interventions on incompetent perforating veins remains a subject of debate. Current reviews and guidelines point to the heterogeneity of the evidence base regarding the indications, techniques, and expected clinical effects of perforator reflux correction, especially in patients with more severe forms of chronic venous disease [10–16].

One important but under-studied aspect remains the impact of the dissection technique itself on the profile of local postoperative complications in the treatment of incompetent

perforating veins. Traditional dissection does not always fully minimize damage to surrounding soft tissues and vascular structures. Excessive dissection of the vascular-tissue complex, additional disruption of local arterial blood supply, and tissue trauma can contribute to the development of subcutaneous hemorrhages, increased postoperative edema, ischemic skin changes, and a delay in reparative processes. In patients with pre-existing trophic changes, this issue takes on particular clinical significance [9,10].

Consequently, the search for less invasive surgical approaches aimed at reducing local surgical trauma while maintaining adequate control of pathological venous shunting is clinically justified. One such approach may be a modified dissection of the incompetent perforating vein with preservation of the accompanying artery. It is hypothesized that more careful dissection of the pathologically altered venous segment and preservation of the arterial component in the area of intervention may help reduce the severity of local postoperative complications and improve the course of the early postoperative period.

Thus, in patients with chronic venous insufficiency of the lower extremities classified as CEAP C3–C5, the effectiveness of surgical treatment is determined not only by the complete elimination of pathological venous reflux, but also by the severity of surgical trauma in the area of intervention. In this regard, it is of interest to evaluate surgical techniques that allow for reduced tissue damage and a lower incidence of local postoperative complications.

Purpose of the study. To evaluate the impact of a modified dissection technique for incompetent perforating veins, with preservation of the accompanying artery, on the incidence of local postoperative complications in the surgical treatment of chronic venous insufficiency of the lower extremities (CEAP C3–C5).

Materials and Methods.

This study was conducted at the Department of Cardiovascular Surgery of the Medical Hospital of Semey State Medical University from 2018 to 2021. The study was designed as a single-center, prospective, non-randomized, comparative clinical study aimed at evaluating the effect of the dissection technique for incompetent perforating veins on the incidence of local postoperative complications in patients with chronic venous insufficiency of the lower extremities classified as CEAP C3–C5.

The study included 62 patients with clinically significant chronic venous insufficiency of the lower extremities who required surgical treatment. The patients' ages ranged from 22 to 48 years. Depending on the type of surgical technique used, all patients were divided into two groups. The main group consisted of 32 patients who underwent surgery using a modified technique for dissecting incompetent perforating veins while preserving the accompanying artery. The comparison group included 30 patients who underwent surgery using the traditional technique.

The inclusion criteria were: the presence of chronic venous insufficiency of the lower extremities classified as CEAP C3, C4, or C5; confirmed by clinical examination and duplex ultrasound

scanning, insufficiency of superficial and/or perforating veins with the formation of pathological vertical and/or horizontal veno-venous reflux; the presence of indications for surgical treatment; the patient's informed consent to surgical intervention and the use of de-identified clinical data for scientific purposes.

Exclusion criteria included chronic venous disease classified as CEAP C1–C2, acute thrombophlebitis of superficial veins, significant comorbidities that limited the ability to perform the procedure to the planned extent, as well as cases in which the local condition of the limb or the patient's general condition did not allow for a standard staged surgical approach.

The preoperative evaluation included a review of the patient's complaints and medical history, a clinical examination, an assessment of the local venous status of the lower extremities, and a duplex ultrasound scan of the venous system. During instrumental diagnostics, the presence and extent of varicose transformation of the subcutaneous veins, the condition of the saphenofemoral and saphenopopliteal junctions, the severity of vertical and horizontal reflux, the localization of incompetent perforating veins, and their hemodynamic significance were assessed. For an additional quantitative characterization of the clinical severity of the disease, the VCSS scale was used, which was applied both during the initial assessment and during follow-up.

In the main group, surgical treatment was performed using a developed method for dissecting incompetent perforating veins. The essence of the technique lay in the selective isolation of the pathologically altered venous segment with the utmost care for the surrounding tissues and the mandatory identification and preservation of the accompanying artery. This approach was aimed at reducing intraoperative trauma, limiting damage to the local microcirculatory bed, and preserving tissue perfusion in the area of intervention. From a clinical standpoint, this was considered one of the mechanisms for preventing postoperative edema, subcutaneous hemorrhages, impaired healing, and ischemic skin changes.

In the control group, surgical treatment was performed using the conventional method. The extent of the procedure was determined by the nature of the venous pathology and included standard steps of phlebosurgical correction: ligation and transection of hemodynamically incompetent venous segments, removal of varicose segments of the subcutaneous veins, and dissection of incompetent perforating veins using the standard technique. In contrast to the modified approach, the traditional technique did not involve the targeted preservation of the accompanying artery, which was potentially associated with greater soft tissue trauma and a more pronounced impairment of local tissue perfusion.

Postoperative management of patients in both groups included a standard set of therapeutic and preventive measures: clinical observation, monitoring of the postoperative wound, dressings, elastic compression of the lower extremities, early mobilization, and symptomatic drug therapy as indicated. In the immediate postoperative period, the nature and frequency of local complications were recorded. The main complications analyzed included subcutaneous hematomas, ecchymoses, postoperative limb edema, skin necrosis in the surgical site, as well as other

local disturbances in wound healing, if they were observed in the early postoperative period.

The primary endpoint of the study was the overall incidence of local postoperative complications. Additionally, the composition of complications by type and their distribution across the comparison groups were analyzed. The secondary endpoint was the change in clinical disease severity as measured by the VCSS scale during the postoperative period.

Statistical analysis of the results was performed using SPSS Statistics 20.0. The two-tailed exact Fisher's exact test was used to compare frequency measures between groups. Quantitative and ordinal measures, including VCSS scores, were analyzed using nonparametric methods, specifically the Mann–Whitney U test. Differences were considered statistically significant at $p < 0.05$. To assess the clinical significance of differences in the primary endpoint, we additionally calculated the absolute risk reduction, relative risk reduction, relative risk, and the number needed to treat (NNT) to prevent one adverse outcome using the modified technique.

The study was conducted in accordance with the principles of the Declaration of Helsinki. All patients signed informed consent forms to participate in the study and to allow the processing of their clinical data. The study protocol was approved by the local bioethics committee of the Semey State Medical University.

Research findings.

General Characteristics of the Observations:

The study included 62 patients with chronic venous insufficiency of the lower extremities classified as CEAP C3–C5, who underwent surgical treatment at a specialized vascular hospital. The main group consisted of 32 patients who underwent surgery using a modified technique for dissecting incompetent perforating veins while preserving the accompanying artery. The comparison group consisted of 30 patients who underwent traditional surgical procedures.

The mean age of patients in the main group was 37.6 ± 3.1 years, and in the comparison group, 38.4 ± 3.3 years; no statistically significant differences in age were found between the groups ($p > 0.05$). The groups were also comparable in terms of the distribution of patients by CEAP clinical classes and by baseline disease severity as assessed on the VCSS scale. This allowed us to consider the baseline characteristics of the patients as homogeneous and to interpret subsequent differences primarily as a result of differences in surgical technique rather than baseline heterogeneity of the sample.

The data presented confirm that the groups being compared are comparable in terms of key baseline parameters, which is essential for a proper assessment of treatment outcomes.

Pattern of Local Postoperative Complications:

An analysis of the early postoperative period revealed that local complications following surgical treatment of chronic venous insufficiency of the lower extremities remain clinically significant and are primarily manifested as subcutaneous hematomas, ecchymoses, postoperative edema, and, in some cases, skin necrosis at the surgical site. At the same time, the frequency and nature of complications depended significantly on the dissection technique used for incompetent perforating veins.

In the comparison group, where the traditional technique was used, early local complications were observed significantly more frequently. Subcutaneous hematomas were recorded in 8 of 30 patients (26.7%), ecchymoses in 3 (10.0%), postoperative limb edema in 12 (40.0%), and skin necrosis in 2 (6.7%). In the main group, where a modified technique preserving the accompanying artery was used, complications occurred significantly less frequently: subcutaneous hematomas were detected in 2 of 32 patients (6.3%), postoperative edema in 1 (3.1%), while ecchymoses and skin necrosis were not recorded in this group.

A comparative analysis of specific types of complications revealed statistically significant differences between the groups regarding subcutaneous hematomas and postoperative limb edema. The incidence of subcutaneous hematomas in the main

group was significantly lower than in the comparison group (6.3% vs. 26.7%; $p = 0.040$). The most pronounced differences were observed in the incidence of postoperative swelling: 3.1% versus 40.0%, respectively; $p < 0.001$. For ecchymoses and skin necrosis, the differences in this sample were not statistically significant; however, the trend of the differences also favored the modified technique.

It should be noted that some patients experienced more than one local complication; consequently, the total number of complications exceeded the number of patients who experienced a complicated postoperative course.

The most common complication in the conventional treatment group was postoperative limb edema. This has fundamental clinical significance, since in patients with CEAP C3–C5 chronic venous insufficiency, edema reflects not only a reaction

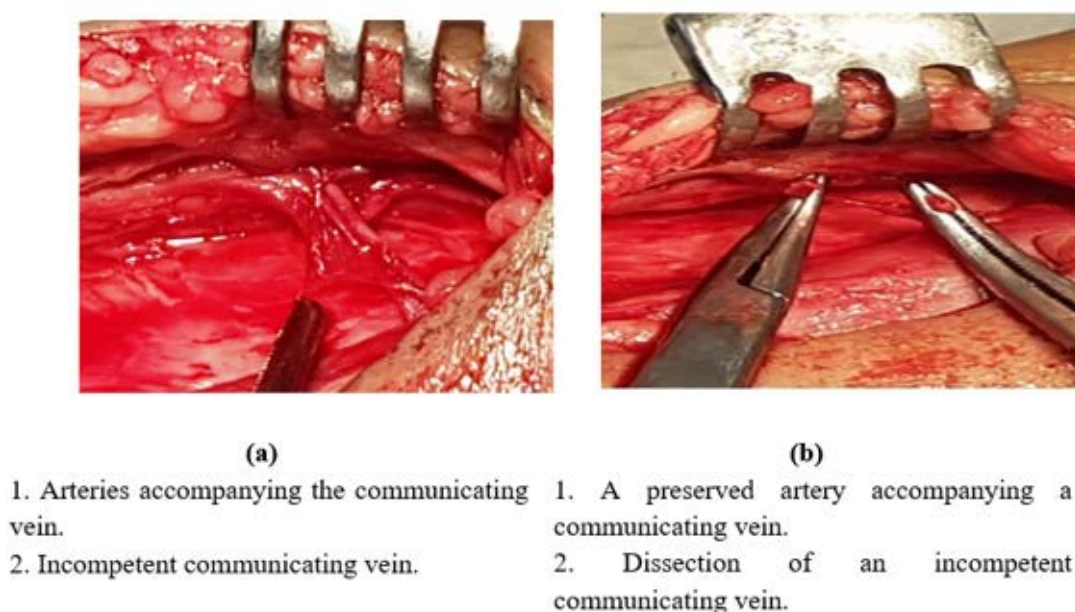


Figure 1. Intraoperative steps of a modified dissection of an incompetent perforating vein with preservation of the accompanying artery.

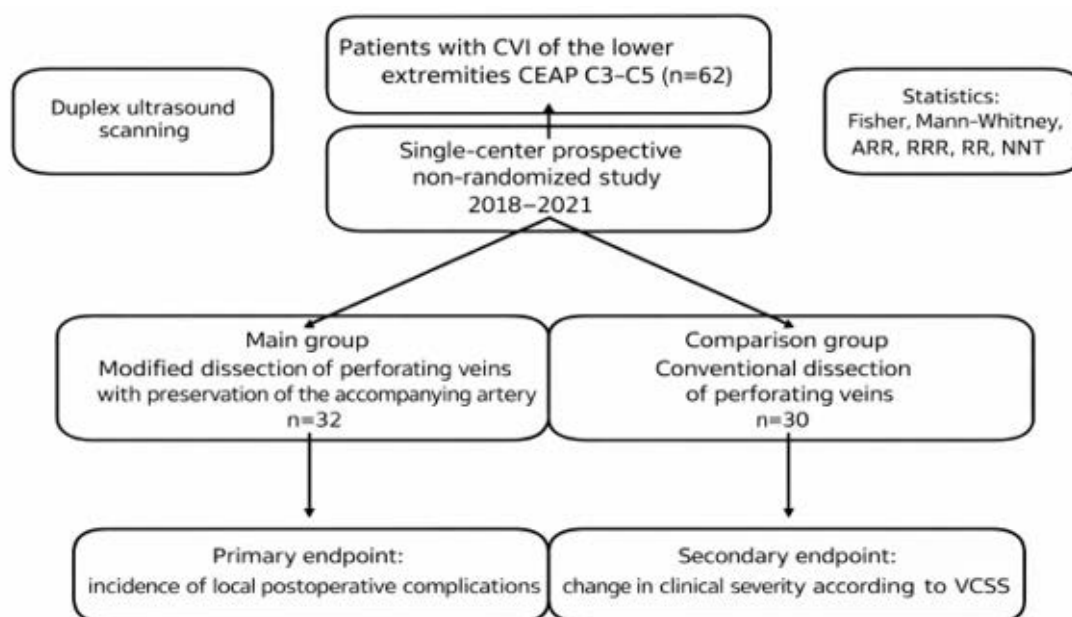


Figure 2. Study design and patient allocation to groups.

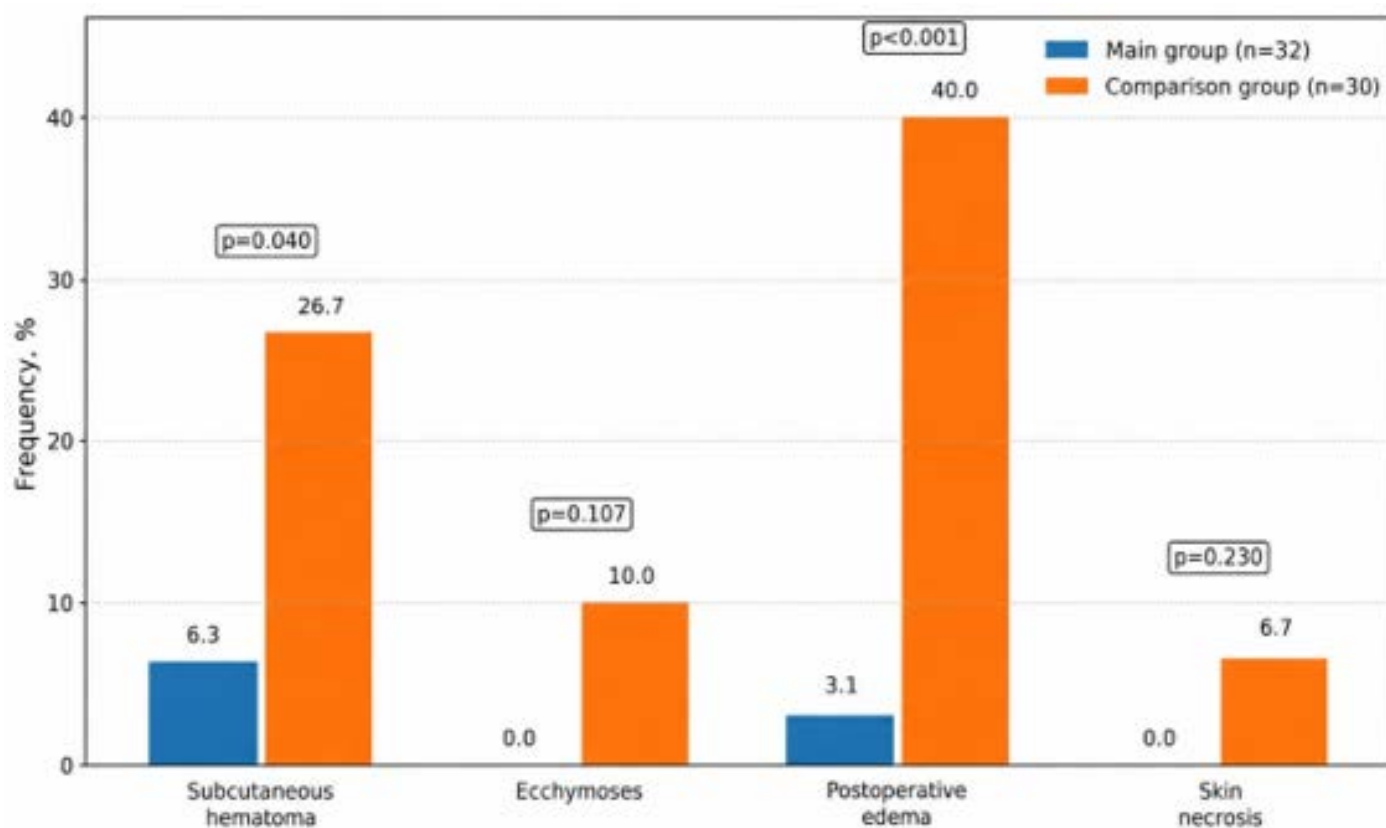


Figure 3. Distribution of local postoperative complications in the main group and the comparison group.

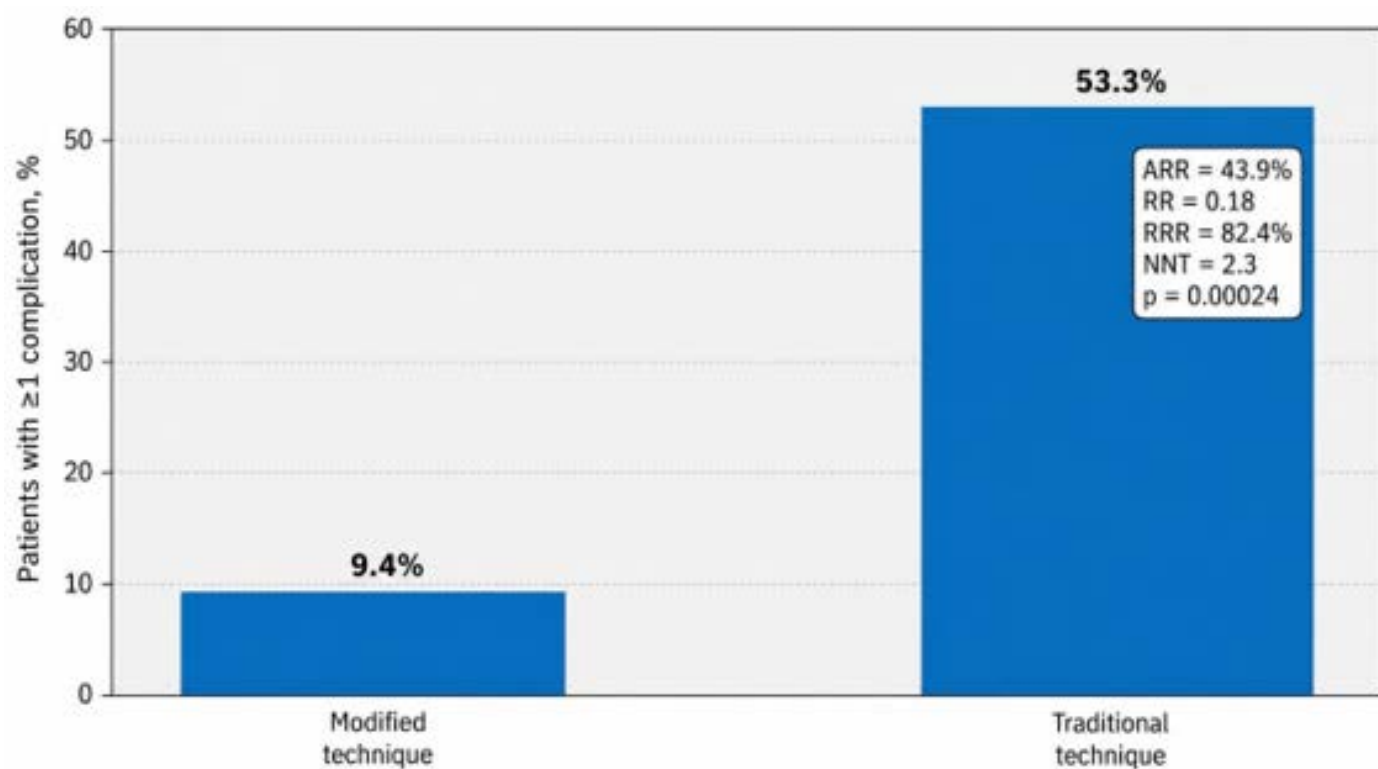


Figure 4. Comparative overall incidence of local postoperative complications in the main group and the comparison group.

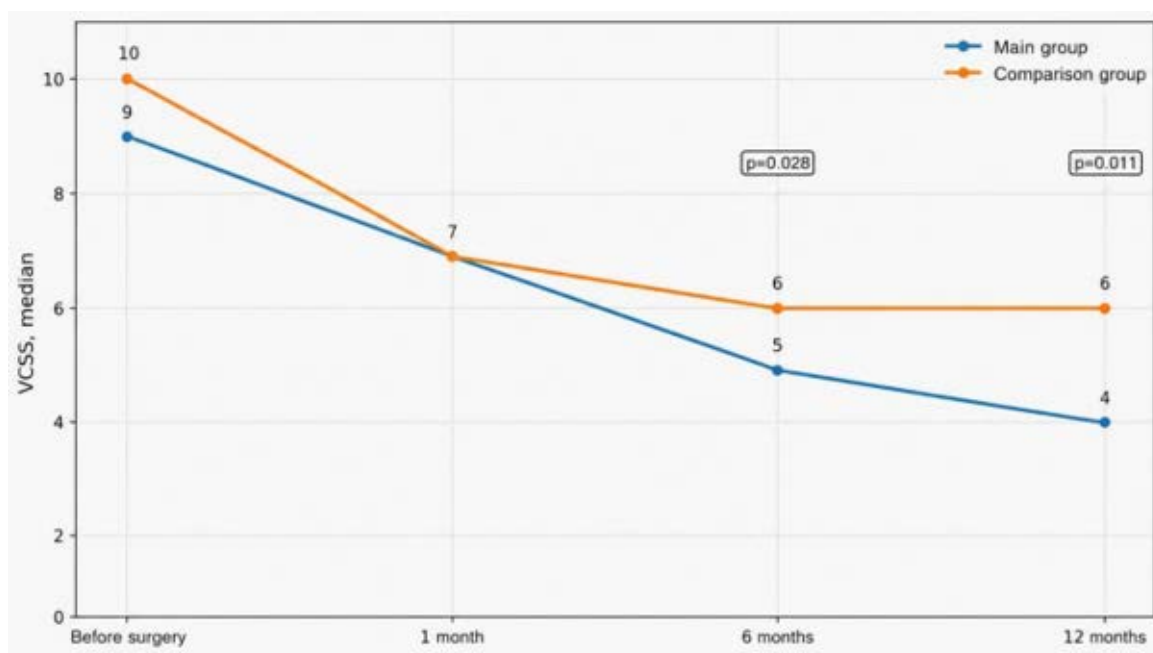


Figure 5. Changes in VCSS scores before surgery and 1, 6, and 12 months after surgical treatment.

Table 1. General Characteristics of the Study.

Indicator	Description
Type of study	A single-center, prospective, non-randomized comparative study
Duration	2018–2021
Clinical facilities	Department of Cardiovascular Surgery, Semey State Medical University Hospital
Total number of patients	62
Age	22–48 years
Main group	32 patients, modified dissection of incompetent perforating veins
Comparison group	30 patients, conventional surgical technique
Inclusion criteria	CEAP C3–C5 chronic venous insufficiency of the lower extremities
Exclusion criteria	CEAP C1–C2, acute thrombophlebitis, inability to perform the procedure in full
Primary endpoint	Incidence of local postoperative complications
Secondary endpoint	VCSS dynamics
Statistical analysis methods	Exact Fisher's test, Mann–Whitney test, calculation of ARR, RRR, RR, NNT, SPSS 20.0

Table 2. Baseline clinical and instrumental characteristics of patients.

Measure	Main group (n=32)	Control group (n=30)	p
Mean age, years	37,6 ± 3,1	38,4 ± 3,3	>0,05
CEAP C3, n (%)	14 (43,8%)	13 (43,3%)	>0,05
CEAP C4, n (%)	12 (37,5%)	11 (36,7%)	>0,05
CEAP C5, n (%)	6 (18,7%)	6 (20,0%)	>0,05
Baseline VCSS, Me [Q1; Q3]	9 [8;11]	10 [8;11]	0,41
Presence of incompetent perforating veins, n (%)	32 (100%)	30 (100%)	—

Table 3. Breakdown of local postoperative complications.

Type of complication	Main group, n=32	Comparison group, n=30	p
Subcutaneous hematoma	2 (6,3%)	8 (26,7%)	0,040
Ecchymoses	0	3 (10,0%)	0,107
Postoperative limb edema	1 (3,1%)	12 (40,0%)	<0,001
Skin necrosis	0	2 (6,7%)	0,230

Table 4. Overall incidence of local postoperative complications.

Indicator	Main group, n=32	Comparison group, n=30	p
Patients with ≥1 local complication	3 (9,4%)	16 (53,3%)	0,00024
Patients without local complications	29 (90,6%)	14 (46,7%)	—

Table 5. Changes in clinical assessment according to the VCSS scale.

Follow-up period	Main group (n=32)	Comparison group (n=30)	p
Before surgery	9 [8;11]	10 [8;11]	0,41
1 month after surgery	7 [6;8]	7 [6;8]	0,57
6 months after surgery	5 [4;6]	6 [5;8]	0,028
12 months after surgery	4 [3;5]	6 [5;7]	0,011

to surgical trauma but also pre-existing disturbances in venous and tissue homeostasis. Against this background, additional surgical trauma can exacerbate local inflammation, impair microcirculation, and slow down reparative processes. Therefore, the marked reduction in the incidence of postoperative edema in the main group should be regarded not only as a statistically significant but also as a clinically significant result.

Equally telling is the reduction in the incidence of subcutaneous hematomas. Their formation was associated with additional local pain, tissue tension, an increase in the volume of dressings, and subjective discomfort during the postoperative period. The significantly lower incidence of hematomas in the main group indirectly indicates a more gentle technique for dissecting the vascular-tissue complex and a lower degree of intraoperative trauma.

Overall incidence of local postoperative complications:

A comprehensive evaluation showed that the overall incidence of local postoperative complications was significantly higher with the traditional surgical technique than with the modified dissection of incompetent perforating veins with preservation of the accompanying artery. In the comparison group, complications were recorded in 16 of 30 patients (53.3%), whereas in the main group, they were recorded in 3 of 32 (9.4%). The differences between the groups were statistically significant (Fisher's exact test, $p = 0.00024$).

The results indicate a significant preventive effect of the modified surgical technique. The absolute reduction in the risk of developing local postoperative complications was 43.9%, the relative risk was 0.18, and the relative risk reduction was 82.4%. The NNT was 2.3, meaning that the practical application of the modified technique in approximately three patients prevents one case of a local postoperative complication.

From a clinical standpoint, these differences appear to be fundamental. While complications were observed in more than half of the patients with the traditional surgical approach, they occurred in fewer than one in ten patients when the modified technique was used. These findings support the clinical relevance of the modified technique and suggest that the observed differences are likely related to the lower degree of surgical trauma.

It is particularly important that the preventive effect extended not only to a reduction in the number of relatively mild local complications, but also to an overall improvement in the procedure's safety profile. There were no cases of skin necrosis or ecchymosis in the main group, and hematomas and edema were rare.

Characteristics of the early postoperative period:

A qualitative analysis of the early postoperative period showed that the course of recovery was more favorable in patients in the main group. The absence of significant local edema, rare

hematoma formation, and the absence of necrotic changes created better conditions for postoperative wound healing and allowed for more uneventful patient management in the immediate postoperative period. In contrast, in the traditional surgery group, complicated local postoperative course was observed significantly more often, requiring closer clinical monitoring and additional dressings, and was accompanied by more pronounced subjective discomfort.

Although the original clinical data did not provide detailed information on the duration of hospitalization or the time required for full functional recovery, the body of clinical evidence suggests that the reduction in the incidence of local complications objectively contributed to a smoother postoperative course. This is particularly important in the context of surgical treatment for CEAP C3–C5 chronic venous insufficiency, where even a relatively small additional trauma can have clinically significant consequences against a background of pre-existing venous outflow disorders, interstitial edema, and microcirculatory impairment.

Thus, the more favorable course of the early postoperative period in the main group was characterized not only by a lower incidence of complications but also by milder local changes, with no cases of skin necrosis and no marked ecchymoses, which indirectly suggests that the procedure was less traumatic.

Changes in clinical disease severity according to the VCSS scale:

Further analysis of the results was conducted using the VCSS scale, which allows for the assessment of the clinical course of the disease following surgical treatment. Prior to surgery, no statistically significant differences between the groups were observed for this parameter, which further confirmed their baseline comparability. One month after treatment, an improvement in clinical status was observed in both groups; however, no significant intergroup differences were identified at this time point.

At later follow-up time points, the differences became more pronounced. Six months after the intervention, positive trends persisted in both groups; however, they were less pronounced in the conventional treatment group. The differences between the groups reached statistical significance ($p = 0.028$). Twelve months later, positive clinical trends persisted in the main group, whereas in the comparison group, the rate of improvement was less pronounced; the differences between the groups also remained statistically significant ($p = 0.011$).

As can be seen from the data presented, the groups were comparable in terms of the clinical severity of venous insufficiency prior to surgical treatment. One month after the procedure, a reduction in the severity of clinical symptoms was observed in both groups; however, no significant difference between the groups was noted for this parameter. Six months

later, the median VCSS score in the main group was 5 [4;6] points, whereas in the comparison group it was 6 [5;8] points. Twelve months later, the differences persisted and became even more pronounced: 4 [3;5] versus 6 [5;7] points, respectively.

These findings are of secondary but significant importance, as they indicate that the reduction in the incidence of local postoperative complications is not an isolated effect but is associated with more favorable clinical outcomes during the subsequent follow-up period.

Thus, the present study demonstrated that when using traditional surgical techniques, local postoperative complications occur quite frequently in patients with chronic venous insufficiency of the lower extremities (CEAP C3–C5), whereas the use of modified dissection of the incompetent perforating vein with preservation of the accompanying artery is associated with a marked reduction in these complications. The most significant differences concerned postoperative edema and subcutaneous hematomas. The overall complication rate decreased from 53.3% to 9.4%, which was accompanied by a more favorable course of the early postoperative period and better clinical outcomes on the VCSS scale during the subsequent follow-up period.

Discussion.

The results obtained indicate that local postoperative complications following surgical treatment of chronic venous insufficiency of the lower extremities in patients with CEAP clinical classes C3–C5 remain clinically significant and are largely determined by the nature of the surgical technique used. In this study, the overall incidence of local complications in the group receiving traditional surgical treatment was 53.3%, whereas it was 9.4% when using a modified technique for dissection of incompetent perforating veins with preservation of the accompanying artery. The most pronounced differences were observed in terms of postoperative edema and subcutaneous hematomas. The absence of ecchymoses and skin necrosis in the main group further indicates a more favorable safety profile of the proposed technique.

The observed differences appear clinically consistent when considering current understanding of the pathogenesis of chronic venous insufficiency. Patients with CEAP classes C3–C5 already exhibit signs of venous outflow decompensation at baseline, including chronic interstitial edema, venous hypertension, microcirculatory disorders, inflammatory remodeling of the vascular wall, and secondary trophic changes in the skin and subcutaneous tissue [4-6,9,10]. Against this background, any additional surgical tissue trauma is tolerated worse than in patients with less severe forms of chronic venous disease. Consequently, even moderate intraoperative trauma in the surgical site may be accompanied by increased local edema, more pronounced tissue hemorrhage, impaired local blood supply, and a delay in reparative processes [5,7,9].

One of the most significant findings of this study is the marked reduction in the incidence of postoperative limb edema. In the conventional treatment group, this complication was observed in 40.0% of patients, whereas in the group treated with the modified technique, it occurred in only 3.1%. This difference is of fundamental importance, since for patients with CEAP C3–

C5, edema is not merely a transient reaction to the procedure, but a reflection of an already impaired venous-tissue balance. Increased edema in the postoperative period can lead to additional tissue tension, impaired microcirculation, prolonged pain, and delayed healing of the postoperative wound [5-7,9]. Therefore, the marked reduction in the incidence of this complication in the main group should be considered one of the key clinical effects of the proposed approach.

Equally important is the reduction in the incidence of subcutaneous hematomas—from 26.7% in the control group to 6.3% in the main group. Although hematomas are often considered relatively “minor” local complications, in actual clinical practice they have a significant impact on the course of the early postoperative period. Their presence is accompanied by increased local pain, a greater need for dressings, prolonged local recovery, and a poorer subjective assessment of treatment outcomes by the patient [7,8,17]. In this regard, the reduction in the incidence of hematomas when using the modified technique confirms its lower invasiveness and the gentler nature of dissection in the perforator complex area.

The pathophysiological differences identified appear to be related to the fact that the developed technique involves the selective isolation of the incompetent perforating vein and preservation of the accompanying artery. This approach reduces gross skeletonization of the vascular-tissue complex, limits additional damage to surrounding tissues, and likely contributes to better preservation of local tissue perfusion. Against a background of chronic venous hypertension, inflammatory changes in the vascular wall, endothelial dysfunction, and oxidative stress, even a slight additional deterioration in tissue blood supply can exacerbate existing microcirculatory and trophic disorders [9,10]. From this perspective, preserving the arterial component in the dissection zone has not only anatomical but also clinically justified significance, especially in patients with more severe forms of chronic venous pathology.

The data obtained also underscore the independent importance of the choice of surgical technique in procedures involving incompetent perforating veins. In recent years, interest in this issue has intensified again; however, current reviews and guidelines indicate that the evidence base regarding optimal treatment strategies for perforating vein insufficiency remains limited and inconsistent [11-16]. The most compelling indications for correcting perforator reflux are discussed in patients with trophic changes and ulcer-associated disease progression, whereas a number of unresolved issues remain in some patients with symptomatic forms [12-16]. Against this background, the results of the present study do not claim to definitively determine the indications for interventions on perforating veins in general; however, they convincingly demonstrate that, once a decision for surgical correction has been made, the surgical technique itself is of independent importance for the prevention of postoperative complications.

A comparison of the obtained results with data from the current literature on complications of invasive treatments for venous disease also confirms their clinical plausibility. According to reviews and guidelines, the most common early adverse events following surgical and endovenous interventions include hematomas, ecchymoses, local inflammatory changes,

skin lesions, hyperpigmentation, pain syndrome, and impaired healing [7,8,17]. Although a significant portion of the current literature is devoted to minimally invasive endovenous technologies, the general principle remains the same: the less intraoperative trauma there is and the more carefully the surgeon handles the tissues in the intervention area, the more favorable the early postoperative period is [2,3,7,8]. It is precisely in this context that the absence of ecchymoses and skin necrosis in the main group, as well as a significant reduction in the incidence of hematomas and edema, appear to be a natural consequence of a gentler technique.

The combination of a lower incidence of local complications with more favorable clinical outcomes on the VCSS scale lends this study particular added value. Although the VCSS was considered a secondary endpoint in this study, the direction of the changes themselves appears to be significant. The absence of marked intergroup differences in the early postoperative period and their more pronounced manifestation later on indirectly suggest that the benefits of a less traumatic surgical approach are realized not only at the level of the local wound healing process but also at the level of overall clinical recovery [4,18]. In other words, reducing surgical trauma and preventing early local complications likely also influence the patient's subsequent functional adaptation.

The practical significance of this study lies in the fact that the proposed technique may be particularly useful for patients with CEAP clinical classes C3–C5, that is, those at increased risk of postoperative complications. It is precisely in such patients that surgical treatment must address two objectives simultaneously: to eliminate pathological venous shunting while minimizing additional damage to tissues already altered due to chronic venous hypertension, edema, and trophic disorders [5,6,9]. The results obtained allow us to consider modified dissection of an incompetent perforating vein with preservation of the accompanying artery as a valid method for improving the safety of surgical treatment for chronic venous insufficiency of the lower extremities.

However, the study results should be interpreted with consideration of several limitations. The study was conducted at a single center and involved a relatively small sample size, which limits the generalizability of the findings to other clinical populations. Furthermore, the study was non-randomized, making it impossible to completely rule out the influence of unmeasured confounding factors. It should also be noted that the present study focused primarily on local complications in the early postoperative period and changes in clinical severity as measured by the VCSS scale; indicators such as length of hospital stay, time to full functional recovery, and the frequency of late recurrences require separate further study [12–16].

Despite these limitations, the identified pattern appears to be internally consistent and clinically significant. A substantial reduction in the overall incidence of local postoperative complications, a decrease in the incidence of postoperative edema and subcutaneous hematomas, as well as the absence of severe local complications in the main group, allow us to consider the reduction of surgical trauma in the area of the incompetent perforating vein as one of the viable approaches

to improving the safety of surgical treatment in patients with chronic venous insufficiency of the lower extremities (CEAP C3–C5).

Thus, the results of this study suggest that modified dissection of the incompetent perforating vein with preservation of the accompanying artery contributes to a more favorable course of the early postoperative period and can be considered a pathogenetically sound method for preventing local postoperative complications in the surgical treatment of chronic venous insufficiency of the lower extremities [9,10].

Conclusion.

Modified dissection of incompetent perforating veins with preservation of the accompanying artery in the surgical treatment of CEAP C3–C5 chronic venous insufficiency of the lower extremities was associated with a significant reduction in the incidence of local postoperative complications compared with the traditional technique (from 53.3% to 9.4%; $p = 0.00024$) and ensures a more favorable course of the early postoperative period with better subsequent clinical outcomes on the VCSS scale.

Author Contributions.

Conceptualization, Y.A.S., Y.O.M., A.A.D.; methodology, Y.A.S., Y.O.M., A.A.D., N.B.O.; software, Y.A.S., A.A.D., N.B.O., A.D.K.; validation, Y.A.S., Y.O.M., A.A.D., N.B.O., A.D.K.; formal analysis, Y.A.S., Y.O.M., A.A.D., N.B.O.; investigation, Y.A.S., Y.O.M., A.A.D., N.B.O., A.D.K.; data curation, Y.A.S., Y.O.M., A.A.D., N.B.O., A.D.K.; writing—original draft preparation, Y.A.S., Y.O.M., A.A.D.; writing—review and editing, Y.A.S., Y.O.M., A.A.D. visualization, Y.A.S., Y.O.M.; supervision, Y.A.S., Y.O.M.; project administration, Y.A.S., Y.O.M., A.A.D.; funding acquisition, Y.A.S.; All authors have read and agreed to the published version of the manuscript.

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